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(54) Title: <b>A METHOD FOR PREDICTING PRODUCT DEMAND USING SELF-ORGANIZING DEMAND LOOPS</b> (54) Titre: <b>PROCEDE DE PREVISION DE LA DEMANDE DE BIENS AU MOYEN DE BOUCLES DE DEMANDE AUTO-ORGANISATRICES</b>				
(57) Abstract <p>The present invention relates generally to a system and method for predicting future demand for goods and/or services. More specifically, the invention provides a system and method for predicting future demand for goods and/or services based on information obtained from offering for sale options for the goods and/or services at different levels of product, regional and temporal hierarchies.</p> <p>(57) Abrégé <p>La présente invention concerne de manière générale un système et un procédé de prévision de la future demande de biens et/ou de services. L'invention concerne, plus particulièrement, un système et un procédé de prévision de la future demande de biens et/ou de services à partir des données obtenues de l'offre d'options de vente de biens et/ou de services à différents niveaux dans la hiérarchie des produits, régionale et temporelle.</p></p>				

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(54) Title: <b>A METHOD FOR PREDICTING PRODUCT DEMAND USING SELF-ORGANIZING DEMAND LOOPS</b>			
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<div style="display: flex; align-items: center;"><div style="margin-right: 20px;">102</div><div style="border: 1px solid black; padding: 5px; text-align: center;">Define Hierarchy</div></div> <div style="text-align: center; margin: 10px 0;">↓</div> <div style="display: flex; align-items: center;"><div style="margin-right: 20px;">104</div><div style="border: 1px solid black; padding: 5px; text-align: center;">Offer Options at Different levels in the Hierarchy</div></div> <div style="text-align: center; margin: 10px 0;">↓</div> <div style="display: flex; align-items: center;"><div style="margin-right: 20px;">106</div><div style="border: 1px solid black; padding: 5px; text-align: center;">Predict Demand from Sales of the Options</div></div> <div style="text-align: center; margin-top: 20px;">100</div>			

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**Description**

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# A METHOD FOR PREDICTING PRODUCT DEMAND USING SELF-ORGANIZING DEMAND LOOPS

## FIELD OF THE INVENTION

The present invention relates generally to a system and method for predicting future demand for goods and/or services. More specifically, the invention provides a system and method for predicting future demand for goods and/or services based on information obtained from offering for sale options for the goods and/or services at different levels of product, regional and temporal hierarchies.

## BACKGROUND OF THE INVENTION

It is a general problem in marketing in any area to predict product demand for existing goods and services as well as new goods and services. As a non-limiting example, a consumer product company is a central member of a supply chain which takes in raw materials, modifies and combines those raw materials, stores and transports goods in various stages of manufacture and distribution to warehouse and retail outlets, and ultimately specific stock keeping units, SKUs, are purchased by consumers for use.

The ultimate goal of any such supply chain management is to couple the push from the production capacities of the system to the pull from the final consumers. However, it is well known in the art that the capacity to predict consumer demand is very difficult. Consider an analogue to the Linnean hierarchy of species, genus, family, class, order, phylum in biology in the realm of goods and services. As a non limiting example, an SKU such as "head and shoulders" in a given bottle is a species, "Head and Shoulders" shampoo in all types of bottles is a genus, "Head and Shoulders" plus "Pantine" is in the family of "anti-dandruff" shampoos, while there are higher levels of "hair care," "personal hygiene" categories.

The demand for goods and services can also be categorized according to geographic regions and time periods in which the product and/or services are desirable. In general, the capacity to predict demand is bad at low levels of the product Linnean hierarchy, *i.e.*, species and genus levels, as well on small time scales and small spatial scales, *e.g.*, during a short period of time at a specific retail outlet. By contrast, the capacity to predict is better at higher levels of all three hierarchies — hair care products in California in the first quarter of 1999, for example.

In the past, a great deal of effort has been given to predicting demand based on point of sales (POS) data, questionnaires of focus consumer groups, out of date historical data, and so forth. While helpful, the capacity to predict remains sharply limited. Indeed,

this limitation is part of the driving force lying behind the development of lean manufacturing, agile manufacturing, just in time delivery and so forth.

One field in which people speculate, and try to predict, future demand for goods and services is futures and options trading. Futures markets and options of a wide variety exist with respect to both financial instruments and real goods, including commodities such as wheat, corn, soybeans. In general, a futures market for a commodity specifies a price, a time and place of delivery, and possible ancillary contingent conditions. An option affords the buyer of the option the option to purchase the commodity future delivery at a specified date and place and quantity.

A futures contract is a legally binding agreement between two parties to buy or sell in the future, on a designated exchange, a specific quantity of a commodity at a specific price. The buyer and seller of a futures contract agree now on a price for a product to be delivered or paid for at a set time in the future, known as the "settlement date." Although actual delivery of the commodity can take place in fulfillment of the contract, most futures contracts are actually closed out or "offset" prior to delivery.

An option on a commodity futures contract is a legally binding agreement between two parties which gives the buyer, who pays a market determined price known as a "premium," the right (but not the obligation), within a specific time period, to exercise his option. Exercise of the option will result in the person being deemed to have entered into a futures contract at a specified price known as the "strike price." In some cases, an option may confer the right to buy or sell the underlying asset directly, and these options are known as options on the physical asset.

Most of the participants in the futures and options markets are commercial and institutional users of the commodities they trade. For example, a company or individual who holds an asset such as coffee, corn, soybeans, U.S. Treasury bonds, or a portfolio of stocks, wants the value of that asset to increase. That person also wants to limit, if possible, any loss in value. The company or individual may use the commodity markets to take an opposite position which can minimize the risk of financial loss from holding those assets when and if their price changes. This is called "hedging."

Other participants are speculators who hope to profit from changes in the price of the futures contract. A speculator buying a futures contract or call option, or selling a put option, hopes to profit from rising prices, while a speculator selling a futures contract or call option, or buying a put option, hopes to profit from declining prices. Because, unlike a hedger, a speculator does not own the underlying commodity, the components of the underlying index, or other product, losses in the futures market are not offset by gains in the cash market, and speculators can lose substantial amounts.

Although individuals do participate in the market both as hedgers and speculators, in the United States, futures contracts and options on futures contracts must be executed on or subject to the rules of a commodity exchange and an individual cannot trade directly on an exchange. A person or firm must trade on the individual's behalf. Further, futures and options market is limited to certain categories of goods and financial instruments. Vast number of goods and services, for example consumer products and transportation, delivery and household services, are excluded from the futures and options market.

Clearly, there is a need for an enhanced means to understand and predict expected consumer demand for a wide variety of goods and/or services.

### SUMMARY OF THE INVENTION

The present invention provides a system and method for predicting future demand for goods and/or services based on information obtained from offering for sale options for the goods and/or services at different levels of product, regional and temporal hierarchies. The invention is a novel business process that enables operations for realtime coupling of production and consumption, which has heretofore never been achieved.

In one embodiment, the present invention provides a method for predicting demand for one or more goods and/or services. The method comprises the steps of: defining at least one hierarchy having one or more levels for said one or more goods and/or services; offering for sale one or more options for said one or more goods and/or services at different levels of said one or more levels of said at least one hierarchy; and predicting demand for said one or more goods and/or services from purchases of said options.

In a preferred embodiment, the levels of hierarchy for the goods and/or services are defined based on the nature of the products in an analogous manner to the Linnean hierarchy of species, genus, family, class, order, phylum in biology, wherein higher levels correspond to more abstract descriptions of the goods and/or services and lower levels correspond to more detailed descriptions of the goods and/or services.

In another preferred embodiment, the levels of hierarchy for the goods and/or services are defined in terms of geographic regions such as local, state, regional, national, continental and global regions. Higher levels of the hierarchy correspond to larger regions and lower levels correspond to smaller regions.

In yet another preferred embodiment, the levels of hierarchy for the goods and/or services are defined in terms of periods of time such as minutes, hours, days, weeks, months and years, wherein higher levels of the hierarchy correspond to longer periods of time and lower levels correspond to shorter periods of times.

5 The goods and services suitable for the present invention can be any goods or service. As a non limiting example, the goods can be commodities, consumer products and financial instruments and the services can be financial services, transportation and delivery services, and household services.

5 The present invention further provides a system for predicting demand for one or more goods and/or services. The system comprises: means for defining at least one hierarchy having one or more levels for said one or more goods and/or services; means for offering for sale one or more options for said one or more goods and/or services at different levels of said one or more levels of said at least one hierarchy; and means for predicting demand for said one or more goods and/or services from purchases of said options. In a preferred embodiment, the system further comprises means for communicating the options and purchases.

10 The present invention further provides a system for predicting consumer demand for goods and/or services. The system comprises: (a) one or more suppliers of the goods and/or services, wherein the suppliers define at least one hierarchy having one or more levels for the goods and/or services, offer for sale one or more options for the goods and/or services at different levels of said one or more levels of said at least one hierarchy, and predict demand for said goods and/or services from purchases of said options; and (b) one or more consumers of the goods and/or services, wherein the consumers making said purchases of said options.

15 In a preferred embodiment, the system for predicting consumer demand for goods and/or services further comprises a network for communicating said one or more options and said purchases among said suppliers and said consumers. In a more preferred embodiment, the network is the World Wide Web.

20 The present invention further provides computer executable software code stored on a computer readable medium for predicting demand for goods and/or services. The code comprises: code for defining at least one hierarchy having one or more levels for said one or more goods and/or services; code for offering for sale one or more options for said one or more goods and/or services at different levels of said one or more levels of said at least one hierarchy; and code for predicting demand for said one or more goods and/or services from purchases of said options.

25 In addition, the present invention provides a programmed computer system for predicting demand for goods and/or services comprising at least one memory having at least one region storing computer executable program code and at least one processor for executing the program code stored in said memory. The program code comprises: code for defining at least one hierarchy having one or more levels for said one or more goods and/or



services; code for offering for sale one or more options for said one or more goods and/or services at different levels of said one or more levels of said at least one hierarchy; and code for predicting demand for said one or more goods and/or services from purchases of said options.

## BRIEF DESCRIPTION OF DRAWINGS

Figure 1 illustrates a method 100 for predicting demand for one or more goods and/or services.

Figure 2 illustrates the major components of the system 200 of the present invention for predicting demand for goods and/or services.

Figure 3 illustrates a representative computer system 300, in conjunction with which the embodiments of the present invention may be implemented.

## DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a system and method for predicting future demand for goods and/or services based on information obtained from offering for sale options for the goods and/or services. The invention utilizes electronic markets, characterization of goods and services based on using at least one hierarchy, and consumer revealed preferences through purchasing of the goods and services at different levels of the hierarchy.

As discussed, future and option markets function to hedge risk due to volatility in price, or other features such as availability at the date and time and volume required. But futures and options not only allow risk hedging, they thereby typically can smooth the underlying markets. Even more important for the present invention, futures and options contain information that estimates future demand and future prices. Thus, if the corn futures look more valuable than the soybean futures, a farmer may choose to plant more corn than soybean.

The present invention unifies the advantages of future and option markets, electronic selling and buying, and the need for producers to have good forecasts of consumer demand for existing and potential new goods in a real time manner that constructively impacts supply chain performance. A method for synthesizing potential new goods is described in U.S. patent application 09/080,040, titled, "A System and Method for the Synthesis of an Economic Web and the Identification of New market Niches", filed 5/15/98, the contents of which are herein incorporated by reference.

Thus, the cornerstone invention utilizes electronic markets and futures and options over SKUs at different levels of the SKU hierarchy, regional and temporal scales, to

allow customers and producers to hedge risk, and simultaneously yield real time forecasts of customer demand based on customer preferences, as revealed by prices at which such futures and options are currently trading. It is a further feature of this invention to utilize a variety of data mining techniques to analyze the resulting price series of single and multiple futures and options over SKUs at different levels of the SKU, regional, and temporal hierarchy in order to obtain improved demand forecasting.

Simultaneously, in so far as the producer or supplier sells the options or futures to the customer, the money raised thereby can fund the excess production or transport of the SKUs for which excess demand is present. Thus, the creation of a futures and options trading system for a wide range of goods and services affords a mechanism which endogenously helps smooth and autoregulate the supply chain.

As used in the present invention, "product" includes both goods and services. "Product hierarchy" or "SKU hierarchy" is used to mean descriptions of goods and/or services based on the nature and character of the goods and/or services. "Regional hierarchy" is used to mean the supply and/or demand of goods and/or services within specified geographic regions. "Temporal hierarchy" is used to mean the supply and/or demand of goods and/or services within specified periods of time.

Figure 1 illustrates a method for predicting demand for one or more goods and/or services 100. In step 102, the method for predicting demand 100 defines a hierarchy for one or more goods and/or services. Preferably, the hierarchy has multiple levels. In step 104, the method for predicting demand 100 offers for sale options at different levels of the hierarchy. In step 106, the method 100 predicts demand from sales of the options.

In a preferred embodiment, the levels of hierarchy for the goods and/or services are defined in terms of product nature and description in an analogous manner to the Linnean hierarchy of species, genus, family, class, order, phylum in biology, wherein higher levels correspond to more abstract descriptions of the goods and/or services and lower levels correspond to more detailed descriptions of the goods and/or services. As a non limiting example, Head and Shoulder shampoo in a specific package can be described at a species level. It can also be described as a species of the genus of Head and Shoulder shampoos, which in turn is a member of the family of anti-dandruff shampoos. The class of shampoos includes anti-dandruff and other shampoos. The order of hair care product would include, as a member, the class of shampoo and other classes of hair care products, such as the class of conditioners. A higher level, the phylum of personal hygiene products would include, as a member, the order of hair care product. It should be pointed out that neither the description and characterization of the products, nor the number of levels in the product hierarchy is limited to the categories of the above example. A person skilled in the art

would understand how to properly categorize a product and how many levels of product hierarchy are proper for a given product.

In another preferred embodiment, the levels of hierarchy for the goods and/or services are defined in terms of geographic regions such as local, state, regional, national, continental and global regions where the options for the goods and/or services are offered for sale. Higher levels of the hierarchy correspond to larger regions and lower levels correspond to smaller regions. The regional hierarchy is more important for some products than for others. For example, the sale of options for snow blowers would be more region sensitive than the sale of options for stocks. A person skilled in the art would understand the proper ways to define geographic regions for specific goods and/or services.

In another preferred embodiment, the levels of hierarchy for the goods and/or services are defined in terms of periods of time such as minutes, hours, days, weeks, months and years, wherein higher levels of the hierarchy correspond to longer periods of time and lower levels correspond to shorter periods of times. Similar to product and regional hierarchies, the characterization of the temporal hierarchy is also dependent on the nature of the products. For example, prices for stock options may change by the minute, while prices for services for lawn-mowing may change only once a year. A person skilled in the art would understand the proper length for the temporal hierarchy for a particular product.

According to the present invention's method, after defining a goods or service according to different levels of hierarchies, options for the goods or service are offered for sale at different levels of the hierarchies. For example, offers for options can be made for Head and Shoulder shampoos, for anti-dandruff shampoos, or for shampoos. The options can be valid for the next seven days, the next four weeks, or the next six months. Further, the offers can be made to people in the Washington DC area, to people in the Mid-Atlantic region, or to people in the United States.

The goods and services suitable for the present invention can be any goods or service. As a non limiting example, the goods can be commodities, consumer products and financial instruments and the services can be financial services, transportation and delivery services, and household services.

According to the present invention, sales data based on offers accepted is received and analyzed to predict future demand for the goods and services. Prediction of future demand for the goods and/or products can be made using any method and/or process suitable for such predictions and known to persons skilled in the art. In this regard, as a non limiting example, one may use methods and processes disclosed by John C. Hull, Options, futures, & Other Derivatives, 4<sup>th</sup> Ed., Prentice Hall, Upper Saddle River, NJ (2000), the contents of which are herein incorporated by reference. One may also use methods

disclosed by Rudiger Frey and Alexander Stremme, "Market of volatility and Feedback Effects from Dynamic Hedging," Mathematical Finance, vol. 7, n. 4, 351-374 (1997), the contents of which are herein incorporated by reference.

Optionally, the present invention also encompasses the utilization of information on sales of options for goods and/or services from other sources, such as information from futures and options market on commodities and financial instruments and information from a particular manufacturer of goods or supplier of services. The information thus obtained is then used along with the information from the sales of options at different levels of the hierarchies to predict consumer demand. Thus, publicly or otherwise available data is utilized to further help predicting future demand.

Figure 2 illustrates the major components of the system of the present invention for predicting demand for goods and/or services 200. The system 200 comprises one or more suppliers 202 and one or more consumers 204 of the goods and/or services. The suppliers 202 define hierarchies characterizing goods and/or services, and offer options at different levels of these hierarchies to consumers 204. The consumers 204 make purchases of these options. The suppliers 202 predict demand for the goods and/or services from the purchases of the options.

In a preferred embodiment, consumers 204 and suppliers 202 communicate via a communication network 206. In a more preferred embodiment, the communication network 206 is the World Wide Web.

Figure 3 illustrates a representative computer system 300 in conjunction with which the embodiments of the present invention may be implemented. Computer system 300 may be a personal computer, workstation, or a larger system such as a minicomputer. However, one skilled in the art of computer systems will understand that the present invention is not limited to a particular class or model of computer.

As shown in Fig. 3, representative computer system 300 includes a central processing unit (CPU) 302, a memory unit 304, one or more storage devices 306, an input device 308, an output device 310, and communication interface 312. A system bus 314 is provided for communications between these elements. Computer system 300 may additionally function through use of an operating system such as Windows, DOS, or UNIX. However, one skilled in the art of computer systems will understand that the present invention is not limited to a particular configuration or operating system.

Storage devices 306 may illustratively include one or more floppy or hard disk drives, CD-ROMs, DVDs, or tapes. Input device 308 comprises a keyboard, mouse, microphone, or other similar device. Output device 310 is a computer monitor or any other known computer output device. Communication interface 312 may be a modem, a network

interface, or other connection to external electronic devices, such as a serial or parallel port

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While the above invention has been described with reference to certain preferred embodiments, the scope of the present invention is not limited to these embodiments. One skill in the art may find variations of these preferred embodiments which, nevertheless, fall within the spirit of the present invention, whose scope is defined by the claims set forth below.

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## Claims

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What is claimed is:

5                   1.     A method for predicting demand for one or more goods and/or services  
comprising the steps of:  
                  defining at least one hierarchy having one or more levels for said one or more  
5                   goods and/or services;  
10                   offering for sale one or more options for said one or more goods and/or  
services at different levels of said one or more levels of said at least one hierarchy; and  
                  predicting demand for said one or more goods and/or services from one  
15                   or more purchases of said options.

10                   2.     A method as in claim 1, wherein each of said levels of said at least one  
hierarchy corresponds to a description of said goods and/or services.

20                   3.     A method as in claim 2, wherein higher ones of said levels corresponds to  
15                   more abstract descriptions of said goods and/or services.

25                   4.     A method as in claim 2, wherein lower ones of said levels corresponds to  
more detailed descriptions of said goods and/or services.

20                   5.     A method as in claim 2, wherein said levels of said at least one hierarchy  
30                   comprises one or more members of the group consisting of species, genus, family, class,  
order, and phylum.

35                   6.     A method as in claim 1, wherein each of said levels of said at least one  
25                   hierarchy corresponds to a geographic region.

40                   7.     A method as in claim 6, wherein higher ones of said levels corresponds to  
larger ones of said geographic region.

30                   8.     A method as in claim 6, wherein lower ones of said levels corresponds to  
smaller ones of said geographic region.

45                   9.     A method as in claim 6, wherein said levels of said at least one hierarchy  
35                   comprises one or more members of the group consisting of local, state, regional, national,  
continental and global regions.

10. A method as in claim 1, wherein each of said levels of said at least one hierarchy corresponds to a period of time.

11. A method as in claim 10, wherein higher ones of said levels corresponds to longer ones of said period of time.

12. A method as in claim 10, wherein lower ones of said levels corresponds to shorter ones of said period of time.

13. A method as in claim 10, wherein said levels of said at least one hierarchy comprises one or more members of the group consisting of minutes, hours, days, weeks, months and years.

14. The method of claim 1, wherein the goods comprise one or more members of the groups consisting of commodities, consumer products and financial instruments.

15. The method of claim 1, wherein said services comprise one or more members of the group consisting of financial services, transportation and delivery services, and household services.

16. A system for predicting demand for one or more goods and/or services comprising:  
means for defining at least one hierarchy having one or more levels for said one or more goods and/or services;  
means for offering for sale one or more options for said one or more goods and/or services at different levels of said one or more levels of said at least one hierarchy;  
and  
means for predicting demand for said one or more goods and/or services from one or more purchases of said options.

17. A system as in claim 16, further comprising means for communicating said options and said purchases.

18. A system for predicting consumer demand for goods and/or services comprising:



one or more suppliers of the goods and/or services, said suppliers defining at least one hierarchy having one or more levels for the goods and/or services, offering for sale one or more options for said goods and/or services at different levels of said one or more levels of said at least one hierarchy, and predicting demand for said goods and/or services from one or more purchases of said options; and

one or more consumers of the goods and/or services, said consumers making said one or more purchases of said options.

19. A system as in claim 18, further comprising a network for communicating said one or more options and said one or more purchases among said suppliers and said consumers.

20. A system as in claim 19, wherein said network is the World Wide Web.

21. Computer executable software code stored on a computer readable medium for predicting demand for goods and/or services, the code comprising:

code for defining at least one hierarchy having one or more levels for said one or more goods and/or services;

code for offering for sale one or more options for said one or more goods and/or services at different levels of said one or more levels of said at least one hierarchy; and

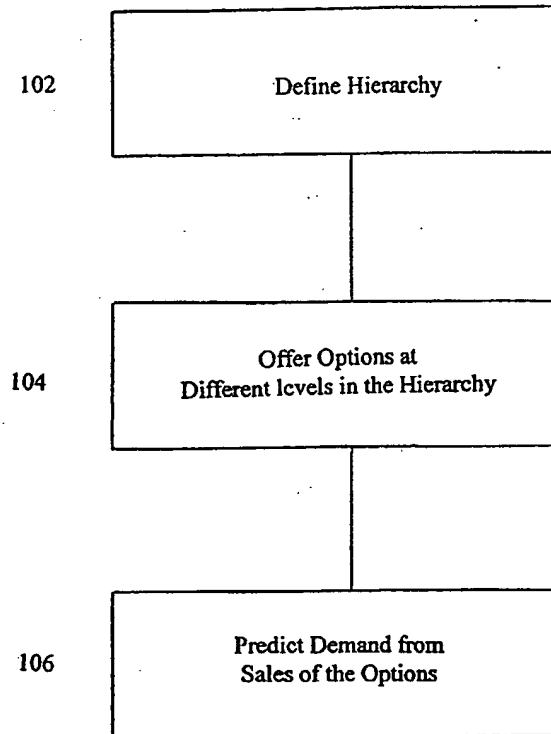
code for predicting demand for said one or more goods and/or services from one or more purchases of said options.

22. A programed computer system for predicting demand for goods and/or services comprising at least one memory having at least one region storing computer executable program code and at least one processor for executing the program code stored in said memory, wherein said program code comprises:

code for defining at least one hierarchy having one or more levels for said one or more goods and/or services;

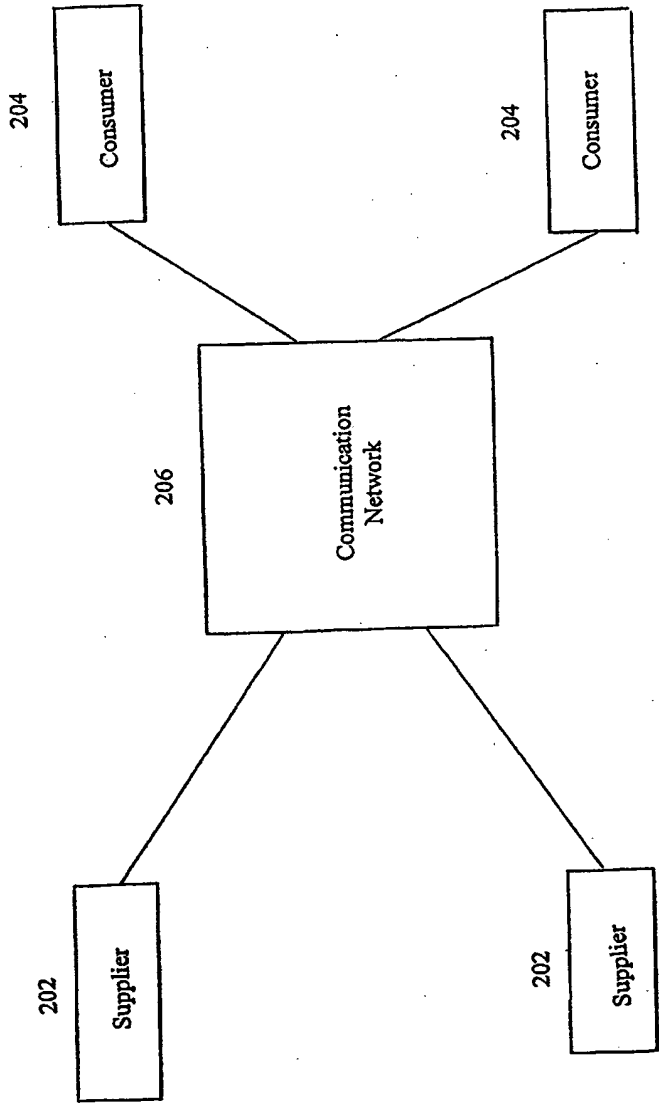
code for offering for sale one or more options for said one or more goods and/or services at different levels of said one or more levels of said at least one hierarchy; and

code for predicting demand for said one or more goods and/or services from one or more purchases of said options.



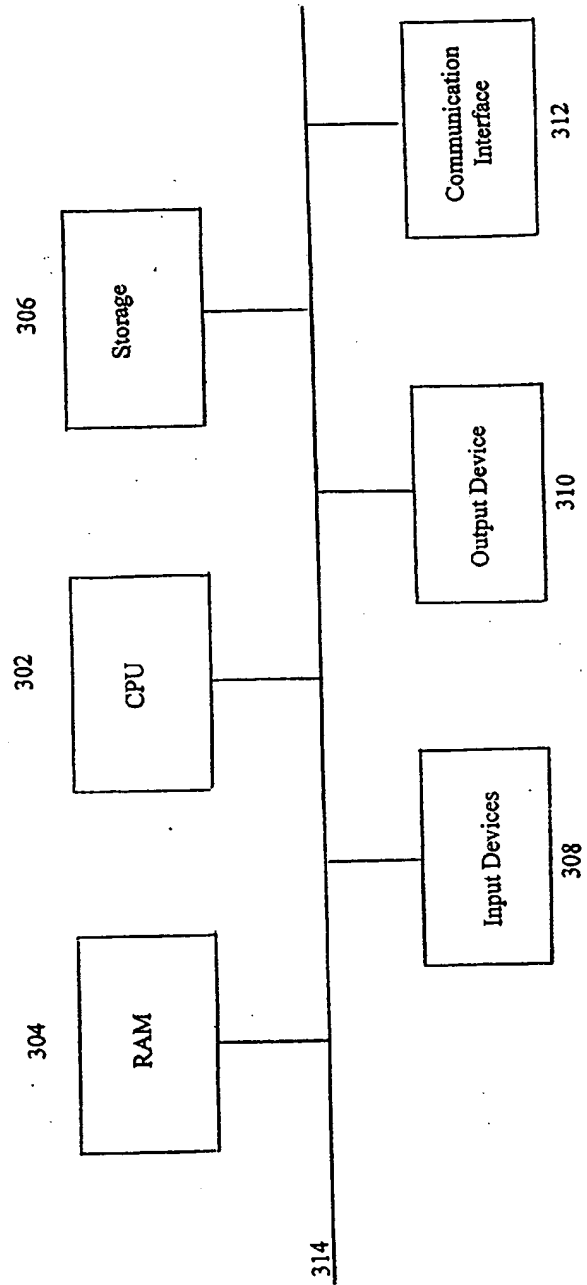
100

Fig. 1



200

Fig. 2



300

Fig. 3